A further examination showed that they grew in the greatest profusion on the shelving side of the trunks of trees with a slant of 10° to 20°; furthermore trunks which were nearly vertical were not inhabited by these minute plant forms. They were, however, nearly always found upon the slanting surfaces near the ground. In some cases the growth extended approximately to a height of 20 or 30 feet, and the position varied as the shelving varied, so that the growth might extend on the same tree at different heights from 90° to 270°.

Rather careful observations thus far obtained tend to show that it is the shelving portions of the trunks of trees which receive and hold the greatest amount of moisture, and as the latter is apparently one of the most important requisites for the development of these green plants, we can readily understand why we find them distributed on nearly all sides of the trees, and not limited, as popularly supposed, to the north side of trees only.— HENRY KRAEMER, *Philadelphia, Pa.*

CONTRIBUTIONS TO THE KNOWLEDGE OF THE PHYSIOLOGY OF KARYOKINESIS.[1]

(WITH ONE FIGURE)

THE investigations, concerning which this is a preliminary report, were undertaken to throw more light upon the subject of the physiology of karyokinesis, a subject which has not received attention commensurate with its importance. This paper presents only the results regarding the relationship of light of various wave-lengths to the rapidity of mitotic nuclear division. The investigations were undertaken at the suggestion of Dr. E. Mead Wilcox and were completed under his direction. I take this opportunity to offer him my sincere thanks for constant and helpful suggestions throughout the course of the investigations.

The roots of *Allium Cepa* were selected as affording the most convenient and suitable objects for the experiments. Bulbs of uniform medium size were selected with great care in the local markets. These bulbs were placed over suitable vessels in such a position that the base of the bulb barely touched the pure water with which the vessels were filled. The usual adventitious roots soon formed, and these were

[1] Contribution from the Botanical Laboratory of the Oklahoma Agricultural and Mechanical College. I. Abstract of thesis.

allowed to attain a length of about one centimeter before the bulb was transferred to the light cages as hereinafter explained.

For the purpose of securing light of various wave-lengths, use was made of the usual double walled bell glasses prepared as follows: The first bell glass was filled with pure water and the second one was painted with a very thick coat of lampblack. Two other bell glasses were filled with solutions *A* and *B* respectively. Solution *A* was made by adding to a 0.06 *n* solution of copper sulfate ammonia until the precipitate ceased to form. Solution *B* consisted of 0.05 *n* solution of potassium bichromate.

For each of the experiments there were selected bulbs having roots at least one centimeter in length, and as many of these as possible were placed under each of the bell glasses prepared as above. The bulbs were then left under these glasses, so arranged as to allow of the normal respiration taking place, for between two and three days before the beginning of the experiment. Roots were then collected from the bulbs under each of the glasses at intervals of four hours during the twenty-four hours of the day. The tips of the roots thus secured were killed in the usual chrom-acetic-acid fixing mixture and imbedded in paraffin according to the usual method. The sections were cut 13.3 μ thick and stained according to Heidenhain's iron-alum-haematoxylin method.[2]

By means of a very simple method, devised during the investigation, it was then possible to count accurately the number of nuclei in the process of division and the number resting. A uniform combination of ocular, tube length, and objective were used throughout the work. In each case the slide was so adjusted as to include in the field nearly all the portion of the root tip lying back of the apical cells, the field being so placed as to include these apical cells. Within this field thus selected it was a relatively simple matter to make very accurate counts of the dividing and resting nuclei. Nuclei were classed as dividing from the first indication of segregation of the chromatic matter in the prophase to the formation of the daughter nuclei at the close of the telophase.

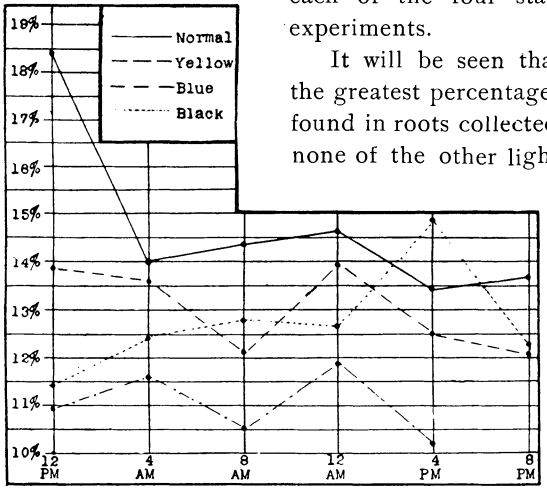
The following tabulation shows the results thus far secured by the use of the above described methods applied to this investigation. Each percentage as given represents the average of nine counts made on three sections taken from each of three roots, each of the three roots used being

[2] LEE, A. B.: The microtomist's vade-mecum 175–176. 1896. [4th ed.]

taken from a different bulb under similar conditions. It seems therefore that the results secured are representative and trustworthy. The percentages are in all case the proportion of nuclei found dividing.

Time	Normal	Yellow	Blue	Black
12 P. M.	18.3 %	13.8½%	10.9 %	11.4 %
4 A. M.	14.0	13.6	11.6	12.4
8 A. M.	14.3	12.1	10.5	12.7
12 A. M.	14.6	13.9	11.8	12.6
4 P. M.	13.4	12.5	10.2	14.8
8 P. M.	13.6	12.1	....	12.3
Averages	14.7 %	12.6 %	11.0 %	12.7 %

In the accompanying figure these same results are represented in the form of curves showing the percentage of dividing nuclei under each of the four stated conditions of the experiments.



It will be seen that in the normal light the greatest percentage of dividing nuclei was found in roots collected at midnight, while in none of the other lights does this same relationship hold true. In the roots grown in darkness there was found the lowest percentage of dividing nuclei, at midnight, and the highest percentage is found at 4:00 P.M.

Future studies must determine if this same relation, as exhibited in the curves shown, exists in cells having active chloroplastids during normal photosynthesis. Studies of this type are now under way, and further discussion of this subject is reserved until the completion of the investigations mentioned.—ARTHUR CARR LEWIS, *Agricultural and Mechanical College, Stillwater, Oklahoma.*